been shown experimentally to add on an approximately 20 log n basis regardless of whether the devices are connected at baseband [2] or at RF [9].

3. The total unfaded end-to-end noise of 41 dBrnC0 is equivalent to an objective of 1.74 pW0p/km. The total unfaded radio noise of +39.9 dBrnC0 is equivalent to an objective of 1.35 pW0p/km.

The above is based on the following general system characteristics:

1 pWC0 = 0 dBrnC0 = -88 dBm0 (unweighted).

1 pW0p = 0 dBrnp0 = -87.5 dBm0 (unweighted).

System is 1800 channels with CCIR emphasis.

Typical hop is 26.7 miles (42.9 km) long.

Nominal loss between transmitter output (power into transmit filter) and receiver input (power into receiver filter) is 63 dB.

Expected end to end RF frequency translation is less than 312 kHz.

IF selectivity at adjacent channel center frequency is 10 dB.

Minimum crosspolarization discrimination (XPD) is 25 dB.

Back-to-back antenna coupling loss is 66 dB.

Side-to-side antenna coupling is 80 dB for copolarization and 83-dB for cross-polarization.

ATT has a short-haul reference circuit [1] in addition to the long-haul reference circuit. The short-haul reference circuit is 10 hops of baseband interconnected radio extending over 250 miles. It has the same end-to-end noise objectives and outage allocations as does the long-haul system. The implied assumption is that a subscriber-to-subscriber voice circuit is connected over either the short-haul or long-haul circuits, but not both.

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Figure 1 Tertiary Interference Paths

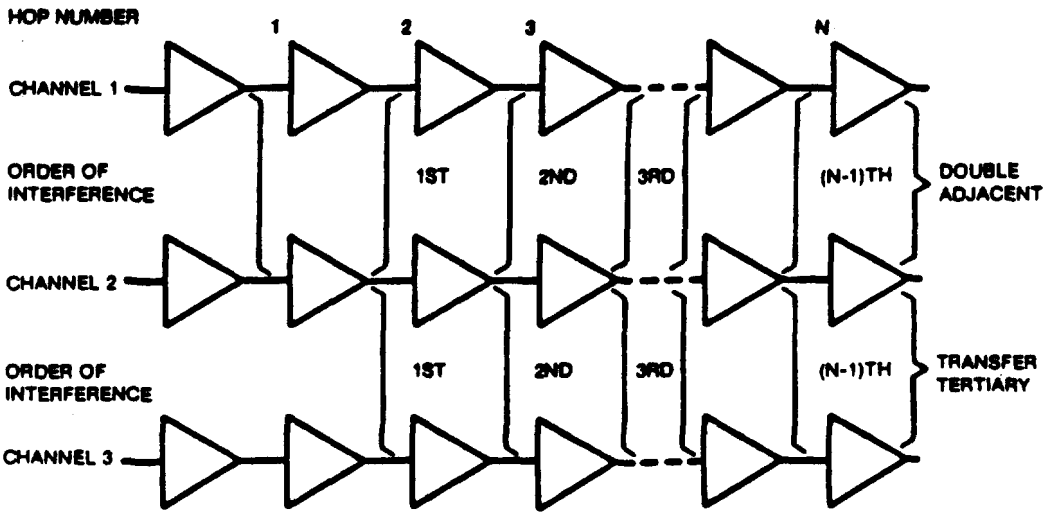


Figure 2 Composite IF/RF Receiver Response

2400 FDM-FM Channels

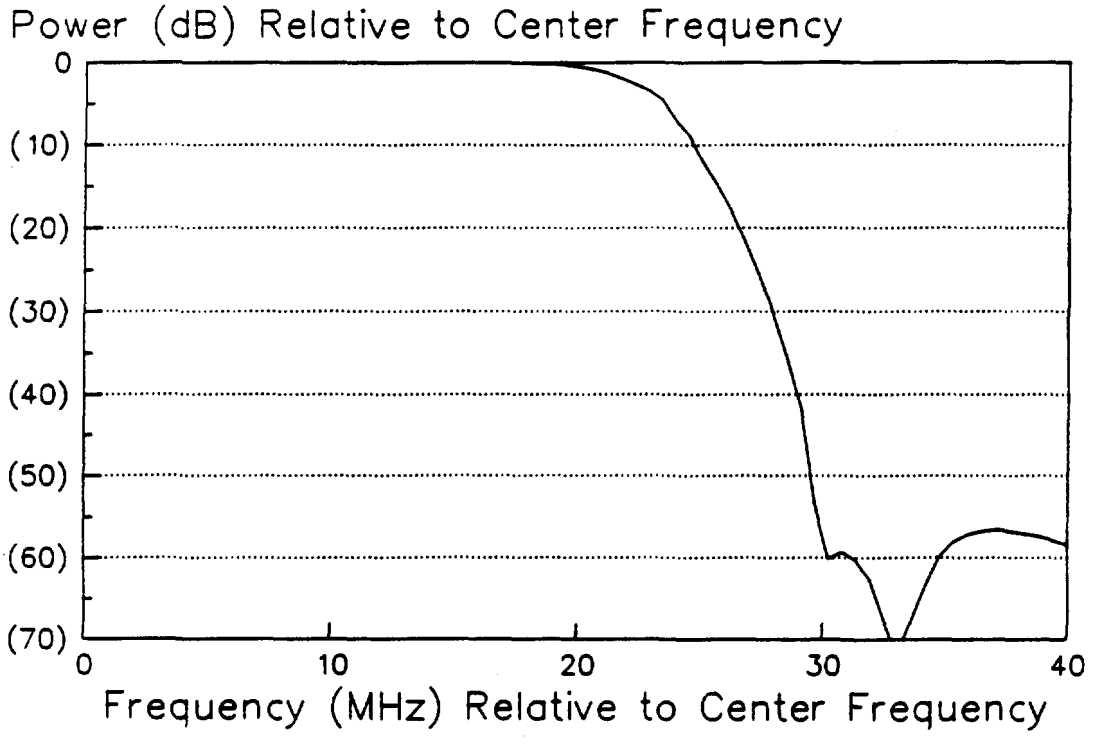


Figure 3 Typical Angle Modulation Spectrums

Power in 4 kHz Bandwidth
Relative to Unmodulated Carrier

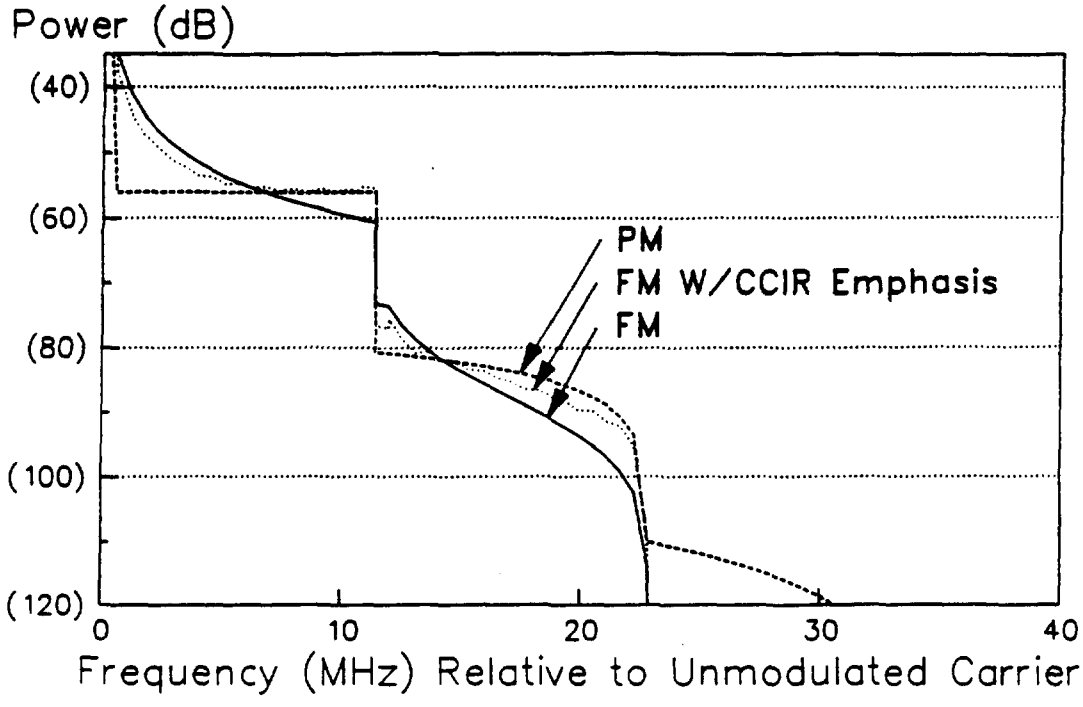


Figure 4 Typical Digital Modulation Spectrums

Power in 4 kHz Bandwidth
Relative to Unmodulated Carrier

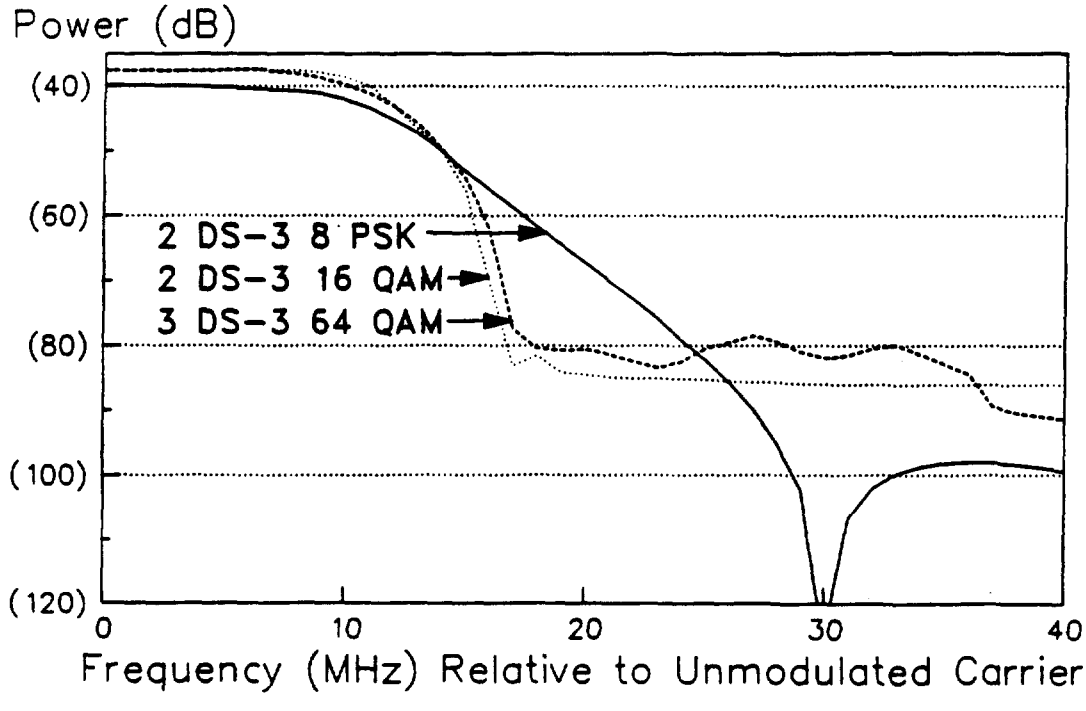


Figure 5 Angle Modulation Interference Curves
Both C and I the Same Modulation Type

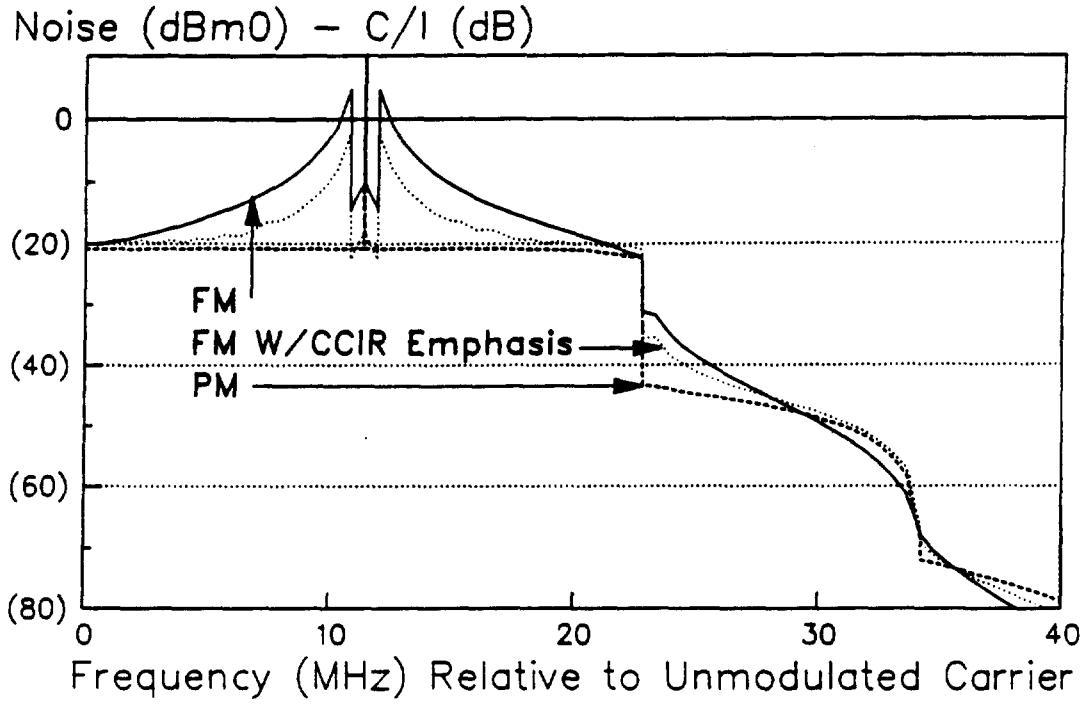


Figure 6 Angle Modulation Interference Curves
Angle Modulation is 2400 Channel FDM
Interference is 2 DS–3 8 PSK Digital

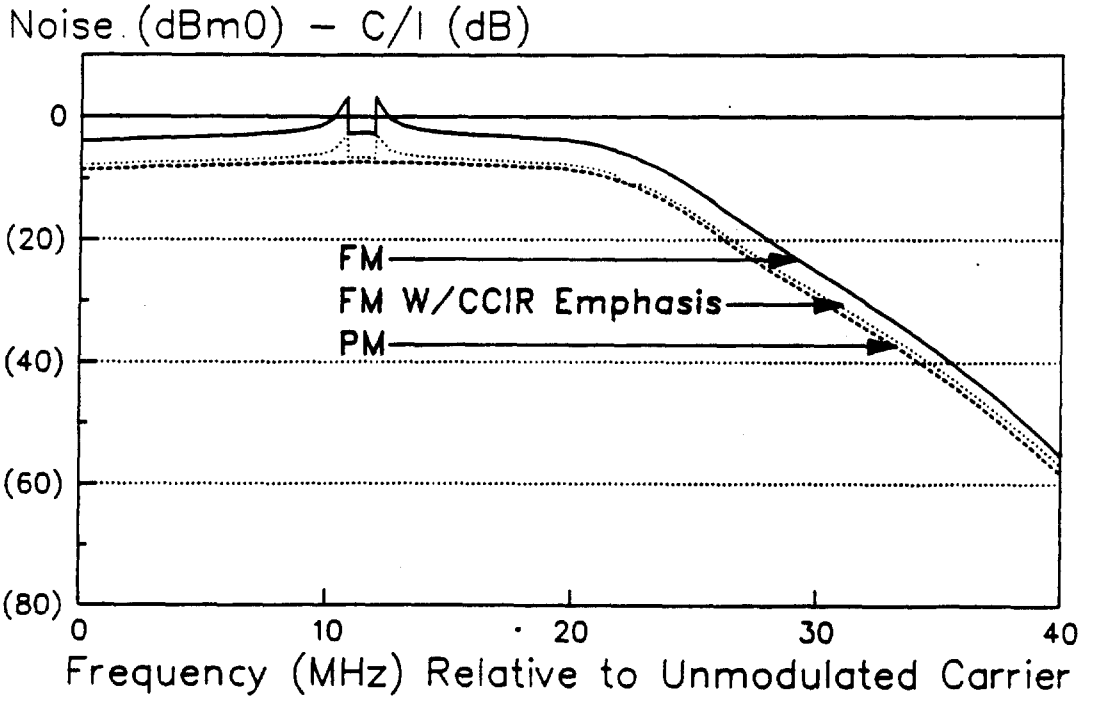


Figure 7 Angle Modulation Interference Curves

Angle Modulation is 2400 Channel FDM
Interference is 2 DS-3 16 QAM

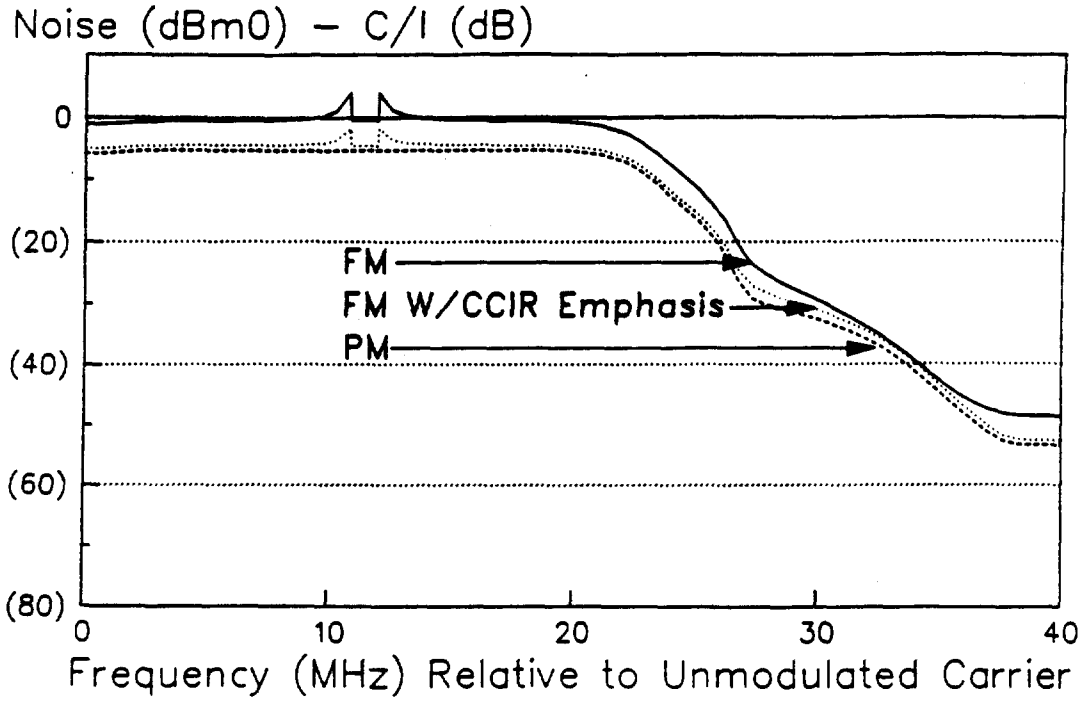


Figure 8 Angle Modulation Interference Curves

Angle Modulation is 2400 Channel FDM
Interference is 3 DS-3 64 QAM

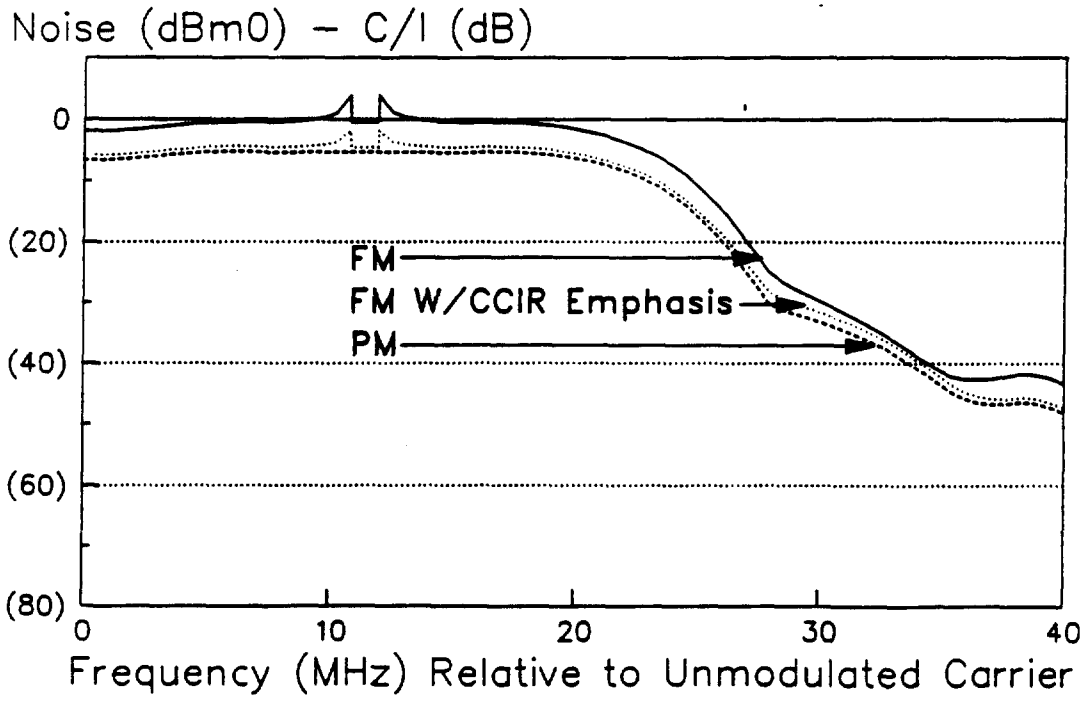


Figure 9 Actual Interference Noise

FM Receiver with CCIR Emphasis

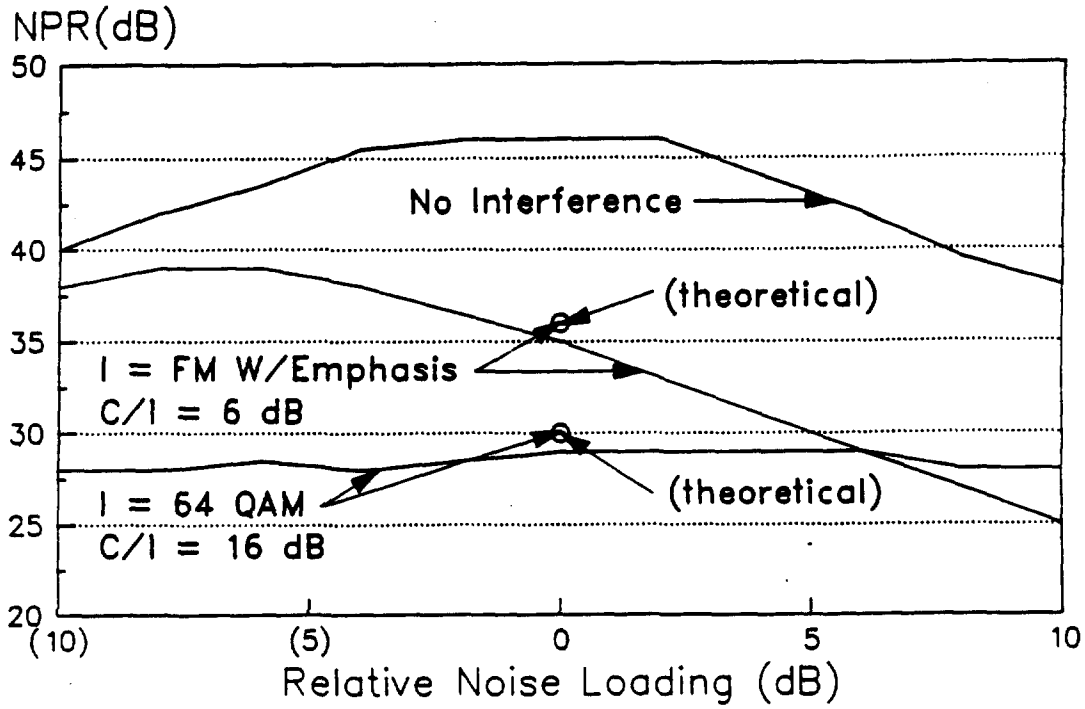
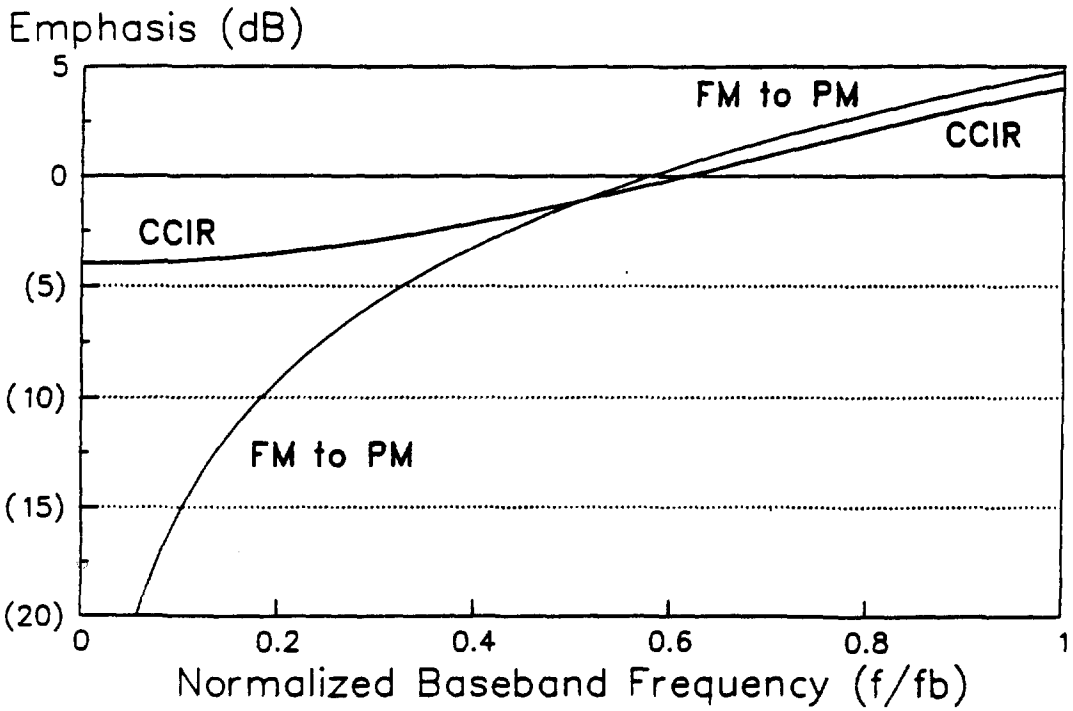


Figure 10 Emphasis Curves



CERTIFICATE OF SERVICE

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January 26, 1993

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Alcatel Network Systems is unable to serve EMI Communications Corporation because its comments do not show an address.

GW03/132614

in Part 21 and Part 94 of the FCC rules, and Northern Telecom supports the proposed changes. Finally, with regard to the power mask rules, Northern Telecom urges continued use of the existing FCC mask under Part 21 and Part 94."

ANS Comment: ANS concurs.

(9/2) "Northern Telecom urges the Commission to adopt a 'two frequency' plan for operation of narrowband channels in common carrier and private operating fix bands between 3 and 11 GHz, which should allow twice the number of users in the same bandwidth as compared to a 'four frequency' plan. Northern Telecom proposes that in those bands, new users, as well as existing users converting from analog to digital or expanding their system, should be required to use a two frequency plan to make more spectrum available. Such requirement would make available adequate capacity using the alternative channelization plan proposed by Northern Telecom to allow the migration of users from the 2 GHz band without jeopardizing the benefits of high capacity wide bandwidth systems."

ANS Comment: ANS concurs. However, ANS must observe that the proposal only has meaning in a multichannel ("multiline") system. Most of the 2 GHz users will be using single channels. Within the context of this FNPRM, the comment is unnecessary. For cases where it applies, the use of "two frequency" plans is a standard frequency planning practice when high performance antennas are used (a proposal consistently mentioned by the common carriers and endorsed by ANS). If antenna standards are improved this will be accomplished by all frequency coordination organizations as a matter of course. See the attached article "External Interference, Introduction,." for more detail.

Public Broadcasting Service

(1/2, 2/1) "PBS's concern is that the proposed common carrier digital channel loading requirements, discussed at Paragraph 31 of the FNPRM and set forth in proposed Section 21.122(a)(2) of the Commission's Rules and Regulations, while perhaps appropriate for the voice channel systems for which they were developed, are inappropriate and burdensome for the digital links that will soon be needed to relay digitally encoded motion video material, such as compressed NTSC and Advanced Television System ("ATV") signals, to broadcasters, including links interconnected to satellite distribution systems."

ANS Comment: ANS concurs. Since digital transmission systems may be used for a wide range of legitimate nontelephony uses, voice channel loading requirements are not appropriate for any form of digital transmission. Digital transmission rate capacity, however, is appropriate.

(2/3, 3/1) "The Commission is currently embarked on an historic proceeding looking toward converting American television broadcasting from the analog NTSC

standard to a new digital ATV standard to be selected in MM docket No. 87-268. This impending change in television broadcast standards, together with new developments in video compression technology generally, will require the conversion of supporting transmission systems, including the microwave link between the PBS TOC and SOC, to digital operation."

ANS Comment: Noted.

(3/2) "When television broadcasting becomes digital, if not before then, PBS's entire distribution system, including the TOC-SOC interconnection link, will have to be converted permanently to digital operation. At that time, the link will presumably become subject to Section 21.122(a)(2). However, the efficiency standards in that section, while perhaps appropriate for voice telephone channels, will present serious problems if applied to television program distribution systems, because they require the use of a digital modulation scheme which is inconsistent with the modulation scheme used by communications satellites that either take a signal from a microwave link or deliver a signal to it."

ANS Comment: ANS does not concur. For the reasons noted below, this argument is technically flawed.

(3/3) "The proposed efficiency standard in Section 21.122(a)(2) requires the use of quadrature amplitude modulation ("QAM"). QAM, while highly efficient, requires highly linear amplifiers. However, highly linear amplifiers are not available on communications satellites, because they consume more power than is available in orbit. To be compatible with the non-linear amplifiers on satellites, earth stations will have to use quadrature phase shift keyed modulation ("QPSK") when uplinking television feeds."

ANS Comment: ANS does not concur. There is no technical reason for fixed point to point microwave radios to use the same spectrally inefficient modulation methods used by satellite transmission systems.

(4/1) "The terrestrial microwave entrance link to the earth station should be modulated in the same way as the earth station uplink. If QAM were required for the terrestrial link and QPSK for the satellite uplink, traffic would have to be reprocessed at the uplink and remodulated before being transmitted to the satellite. That process could introduce additional errors and would add complexity to system control and new costs to the program distribution chain. PBS could alleviate these problems to some extent by moving its TOC to the uplink location, but such a move would be impractical and would involve additional personnel and unnecessary expense and effort to coordinate operations at PBS headquarters in Alexandria and the remote TOC. The proper, effective, and efficient way to operate the public television distribution system is to create the program distribution feed in final digital form at the TOC at PBS headquarters and to have the entire distribution

system act as a transparent end-to-end pipeline all the way to the control rooms of individual public television stations."

ANS Comment: This is an interesting approach technically. However, PBS ignores the basics of modern digital microwave transmission. The system described is a multihop microwave system which is modulated at one location and transmitted over several hops without demodulation. This system is basically an analog radio with a digital modem. Such hybrid systems were used about ten years ago on analog systems requiring digital transmission. Since these systems were so sensitive to errors introduced by the multihop analog systems (very poor fade margin), these systems were soon replaced by real digital systems. Real digital systems accept a payload signal, convert it into a digital signal suitable for radio transmission, and transmit that signal. The digital signal is recovered and retimed on each radio hop. That is one of the ways the system avoids the introduction of errors that would be introduced by a multihop "analog" system. PBS will be hard pressed to find a vendor for the microwave radio it describes - and it is unlikely to enjoy the error performance on normal length paths if it does. If PBS buys high quality commercial microwave digital transmission equipment, it will convert the digitized video payload signal into a signal suitable for transmission, reconstitute that signal after every hop, and then reform the digital payload signal at the end location prior to connection to the satellite link. The digital terrestrial microwave path will be no different than any other commercial microwave link - and should be regulated like the others.

(5/2) "... PBS urges the Commission to provide an exception, perhaps by means of a footnote to Section 21.122(a)(2), stating that:

> Microwave systems carrying digital motion video material, such as television programming, may use modulation schemes consistent with the modulation of the system into or from which their traffic is being fed, without regard to this subsection, provided that they comply with the 1 bit/sec/Hz requirement in Section 21.122(a)(1)."

ANS Comment: ANS does not concur. As noted above, there is no technical reason for this.

Pacific Telesis Group

(2/4) "Permitting Private Users Into the Common Carrier Will Severely Affect Spectrum Available for Common Carrier Use."

ANS Comment: ANS recornizes the need for more spectrum in several locations. That is our motivation for encouraging the dialof with NTIA for more spectrum. However, there is a demonstrated need for more low density channels. As noted below, Pacific Bell is on record as needing low density channels. Their need apparently is the same as the Private Users in many cases. This FNPRM would help Pacific obtain the channels they told NTIA (see below) they need.